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U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
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Letter
Circular
LC-506

SOUND ABSORPTION COEFFICIENTS OF THE MORE COMMON ACOUSTIC MATERIALS.

The following figures have been obtained at the National Bureau of Standards for the sound absorption coefficients of a number of acoustic materials. It is our intention to publish results only for materials which are on the market. The measurements on some of these materials were made several years ago, but we believe these materials are essentially the same as when the measurements were made. The inclusion of a material in this letter circular is not to be construed as a general approval. Each material should be judged on its merits in any particular case as there are other requirements such as fire resisting qualities; light reflection, appearance, etc. Figures are also given for the absorption of an audience seated in chairs of different kinds. All the results have been obtained by the reverberation method on samples having an area of approximately 72 square feet.

The sound absorption coefficient of a material is defined as the fractional part of the energy of a sound wave which is absorbed at each reflection. Experimental figures such as are given here must be regarded as approximate only. This branch of applied science is new and in a state of development. The methods and formulas used in obtaining these figures are those which, while not entirely satisfactory, are open to the least objection. The uncertainty involved is such that all the coefficients are probably somewhat too large.

The "noise coefficient" given in the table is the average to the nearest multiple of 0.05 of the coefficients for 256, 512, 1024 and 2048 cycles. It has been recommended by many consultants that such a coefficient be used when the problem is one of reducing the noise level, as in offices, restaurants, etc.

Fibrous materials and acoustic tiles may exhibit large variations in coefficient arising from different methods of mounting. The figures here given apply only to cases where the materials are mounted in the same manner as when tested.

Acoustic plasters require special skill in their application, as improper manipulation may reduce the coefficient. Particular attention is called to the fact that a dry base coat is used for most applications. Also the sound absorption coefficients are affected quite materially by the time between the application of the first and second coat of acoustic plaster. Moreover, the figures given for plasters without a base coat will be considerably reduced if a base coat is used.

It is not necessarily the case that the materials of highest coefficient are the most advantageous. When there is room enough to apply the requisite quantity, a material of low coefficient will give better results than one of higher absorption, because of the more uniform distribution of material. Also, in comparing different materials it should be borne in mind that there is some variation in manufacture, hence the sample which was measured may have more or less absorption than the material delivered on the job. Minor differences in coefficients, therefore, should be disregarded in choosing between materials.

For the foregoing reasons it is advisable in drawing up specifications for auditoriums to lay emphasis upon the reverberation time desired rather than upon coefficients of material. See Bureau of Standards Circular No. 396 entitled "Architectural Acoustics", which may be obtained of the Superintendent of Documents, Government Printing Office, Washington, D. C. at 5 cents per copy. Additional details regarding any of the materials mentioned in this letter circular will be furnished on application.

Additional information regarding the absorption coefficients of acoustical materials may be obtained from the Acoustical Materials Association, 919 North Michigan Avenue, Chicago, Illinois.

Sound Absorption Coefficients and Description of Test Samples

Table 1
Acoustical Tiles, Cast Materials, Boards and Blankets

The coefficients given in the following table have been modified to some extent from those given in Letter Circular No. 359 and earlier letter circulars. The reason for these changes is to be found in the August, 1934 number of the Journal of Research of the National Bureau of Standards (Research Paper No. 700) entitled "Dependence of Sound Absorption upon the Area and Distribution of the Absorbent Material".

Material	Thickness	Mounting (See Footnote)	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft.	Surface	Date
ACOUSTICAL CORPORATION OF AMERICA													
Mutetile (2" Rockwool)	2 1/2"	4	.53	.71	.80	.78	.76	.45	.75	12"x 12"	- -	Cast plaster of paris perforated 2556 holes per sq ft., dia. 1/16".	1932
ACOUSTONE COMPANY, LTD.													
Trutone Tile, cast on 1/4" gypsum wall board	7/8"	4	.16	.17	.48	.82	.65	.74	.55	12"x 24"	- -	Spray painted by manufacturer.	1932
AMERICAN ACOUSTIC CORPORATION													
Ek-O-less Tile cast on 1" backing.	3/4"	4	.22	.31	.66	.82	.74	.76	.65	11 7/8"x 22 7/8"	12.3	Unpainted	1932
Ek-O-less Tile cast on 1/2" backing.	1 7/16"	4	.18	.32	.85	.92	.77	.81	.70	11 7/8"x 22 7/8"	- -	Unpainted	1932
ARMSTRONG CORK & INSULATION COMPANY													
Ceramacoustic Tile	1 1/8"	1	.34	.48	.63	.66	.65	.58	.60	4 1/2"x 9"	3.4	Unpainted	1932
Ceramacoustic Tile	1 1/8"	1	.28	.49	.62	.62	.66	.54	.60	4 1/2"x 9"	3.4	Spray painted 4 coats at N.B.of S.	1932
Corkoustic Tile	1 1/2"	1	.08	.23	.70	.61	.52	.52	.50	12"x 12"	.83	Painted by mfr.	1936
Temlock	1/2"	5 (16" o.c.)	.24	.31	.27	.27	.36	.47	.30	- -	- -	Unpainted	1931

ARMSTRONG CORK & INSULATION COMPANY (Cont'd)

Material	Thick-ness	Mounting (See Footnote)	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
Temlock DeLuxe	1/2"	4	.12	.24	.39	.31	.31	.32	.30	48"x 54"	1.18	Painted by mfr.	1937
Temlock DeLuxe	7/8"	4	.22	.46	.35	.32	.39	.57	.40	48"x 54"	1.19	" " "	1937
Temlock DeLuxe	1 3/8"	4	.32	.45	.37	.39	.46	.63	.40	48"x 54"	1.65	" " "	1937

THE CELOTEX CORPORATION

Acousti-Celotex Double B	13/16"	1	.15	.24	.62	.73	.70	.71	.55	12"x 12"	- -	Unpainted, perforated 441 holes per sq ft, 1/4" dia., 5/8" deep.	1931
Acousti-Celotex Double B	13/16"	1	.13	.26	.62	.78	.86	.77	.65	12"x 12"	- -	Same as sample above, brush painted 1 coat glue size, 4 coats lead and oil at N.B.of S.	1931
Acousti-Celotex Double B	13/16"	2	.09	.56	.77	.90	.78	.62	.75	12"x 12"	.86	Unpainted, perforated 441 holes per sq ft, 1/4" dia., 5/8" deep.	1933
Acousti-Celotex Triple B	1 1/4"	4	.12	.41	.90	.92	.66	.64	.70	12"x 12"	1.44	Unpainted, perforated 441 holes per sq ft, 1/4" dia., 1" deep.	1932
Acousti-Celotex Type C1	1/2"	1	.12	.26	.48	.50	.46	.56	.45	12"x 12"	.78	R.I.finish, perforated 441 holes per sq ft, 3/16" dia., 3/8" deep.	1936
Acousti-Celotex Type C1 Slow-burning	1/2"	1	.17	.24	.40	.45	.43	.51	.40	12"x 12"	.88	Unpainted, perforated 441 holes per sq ft, 3/16" dia., 3/8" deep.	1936
Acousti-Celotex Type C2	11/16"	1	.11	.31	.71	.80	.67	.57	.60	12"x 12"	.88	R.I.finish, perforated 441 holes per sq ft, 3/16" dia., 1/2" deep.	1936
Acousti-Celotex Type C2	11/16"	2	.14	.65	.63	.73	.67	.55	.65	12"x 12"	.88	R.I.finish, perforated 441 holes per sq ft, 3/16" dia., 1/2" deep.	1936

THE CELOTEX CORPORATION (Cont'd)

Material	Thick-ness	Mounting (See Footnote)	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
Acousti-Celotex Type C2 Slow burning	11/16"	1	.10	.31	.70	.80	.76	.62	.65	12"x 12"	1.10	Unpainted, perforated 441 holes per sq ft, 3/16" dia., 1/2" deep.	1936
Acousti-Celotex Type C2 Slow burning	5/8"	1	.09	.25	.68	.79	.69	.66	.60	12"x 12"	.89	Unpainted, perforated 441 holes per sq ft, 3/16" dia., 1/2" deep.	1937
Acousti-Celotex Type C2 Slow-burning	11/16"	2	.09	.65	.61	.78	.75	.64	.70	12"x 12"	1.10	Unpainted, perforated 441 holes per sq ft, 3/16" dia., 1/2" deep.	1936
Acousti-Celotex Type C3	13/16"	1	.18	.32	.76	.93	.63	.50	.65	12"x 12"	1.11	R.I.Finish, perforated 441 holes per sq ft, 3/16" dia., 5/8" deep.	1936
Acousti-Celotex Type C3	13/16"	8	.55	.66	.66	.80	.69	.52	.70	12"x 24"	1.09	R.I.Finish, perforated 441 holes per sq ft, 3/16" dia., 5/8" deep.	1936
Acousti-Celotex Type C3 Slow-burning	13/16"	1	.18	.36	.67	.74	.67	.66	.60	12"x 12"	1.35	Unpainted, perforated 441 holes per sq ft 3/16" dia., 5/8" deep.	1936
Acousti-Celotex Type C3 Slow-burning	13/16"	8	.45	.58	.67	.91	.71	.66	.70	12"x 24"	1.06	Unpainted, perforated 441 holes per sq ft, 3/16" dia., 5/8" deep.	1937
Acousti-Celotex Type C4	1 1/4"	1	.17	.48	.97	.72	.50	.41	.65	12"x 12"	1.58	R.I.Finish, perforated 441 holes per sq ft, 3/16" dia., 1 1/16" deep.	1936
Acousti-Celotex Type C4	1 1/4"	8	.53	.68	.96	.78	.60	.50	.75	12"x 24"	1.44	R.I.Finish, perforated 441 holes per sq ft, 3/16" dia., 1 1/16" deep.	1936
Acousti-Celotex Type C4 Slow-burning	1 1/4"	1	.13	.51	.94	.84	.58	.52	.70	12"x 12"	1.80	Unpainted, perforated 441 holes per sq ft, 3/16" dia., 1 1/16" deep.	1936

THE CELOTEX CORPORATION (Cont'd)

Material	Thick-ness	Mounting (See Footnote)	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
Acousti-Celotex Type MU-1	1/2"	1	.10	.17	.63	.68	.66	.72	.55	12"x 12"	1.39	Unpainted, not perforated.	1936
Acousti-Celotex Type M1	9/16"	1	.11	.29	.68	.74	.82	.74	.65	12"x 12"	1.23	Painted by mfr., perforated 676 holes per sq ft, 5/32" dia., 1/2" deep.	1936
Acousti-Celotex Type M3	1 1/4"	1	.15	.50	.93	.89	.74	.69	.75	12"x 12"	2.58	Painted by mfr., perforated 676 holes per sq ft, 5/32" dia., 1 1/8" deep.	1936
Calicel Acoustic Tile	3/4"	1	.07	.21	.62	.90	.75	.75	.60	12"x 12"	-	Unpainted	1936
Calicel Acoustic Tile	1"	1	.09	.26	.74	.97	.78	.84	.70	12"x 12"	2.66	Unpainted	1935
Calicel Acoustic Tile	1"	5 (12" o.c.)	.28	.90	.86	.72	.85	.89	.85	12"x 12"	2.66	Unpainted	1935
Calicel Acoustic Tile	1 1/4"	1	.14	.43	.90	.90	.82	.80	.75	12"x 12"	3.42	Unpainted	1935
Calicel Acoustic Tile	1 1/4"	5 (12" o.c.)	.38	.95	.76	.78	.89	.87	.85	12"x 12"	3.42	Unpainted	1935
Calistone	2"	4	.12	.45	.87	.82	.76	.67	.75	12"x 12"	9.3	Unpainted	1935
Calistone	2"	5 (12" o.c.)	.46	.91	.71	.75	.84	.72	.80	12"x 12"	9.3	Unpainted	1935
Calistone	4"	4	.38	.59	.60	.63	.63	.62	.60	18"x 24"	17.8	Unpainted	1937
Absorbex Type A	1"	1	-	.22	.45	.87	.91	-	.60	9"x 9"	2.5	Spray painted by mfr.	1932
Absorbex Type A	1"	2 (9" o.c.)	-	.27	.65	.92	.77	-	.65	9"x 9"	2.5	Spray painted by mfr.	1932
Absorbex Type A on 1" Absorbex Type F (10 gauge)	2"	4	-	.39	.80	.96	.92	-	.75	9"x 9" tile on 20"x 64" sheets.	-	Spray painted by mfr.	1932
Absorbex Type A	1"	9	.19	.63	.95	.86	.78	.77	.80	18"x 18"	2.6	Unpainted	1936
Absorbex Type A	1"	2 (18" o.c.)	.19	.33	.80	.86	.80	.83	.70	18"x 18"	2.7	Kerfed, spray painted 4 coats paint at N.B.of S.	1936

THE CELOTEX CORPORATION (Cont'd)

Material	Thick-ness	Mounting (See Footnote)	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
Absorbex Type C	1"	4	.14	.19	.34	.73	.62	.62	.45	20"x 64"	- -	Unpainted	1932
Absorbex Type C (14 gauge)	1"	2 (20"o.c.)	.14	.21	.67	.69	.59	.62	.55	20"x 64"	- -	Unpainted	1932
Absorbex Type F (10 gauge)	1"	2 (16" o.c.)	.06	.17	.47	.66	.53	-	.45	20"x 64"	- -	Spray painted by mfr.	1934
Absorbex Type F (8 gauge)	2"	7	.13	.47	.98	.70	.78	.70	.75	20"x 64"	4.7	Spray painted 4 coats paint at N.B. of S.	1934

CERTAIN-TEED PRODUCTS CORPORATION

Kalite, cast on 1/4" backing of moulding plaster, Grade D(fine)	1"	4	.09	.30	.49	.54	.47	.48	.45	24"x 36"	-	Unpainted	1936
Kalite, cast on 1/4" backing of moulding plaster, Grade A(Coarse)	1"	4	.06	.19	.42	.69	.74	.64	.50	24"x 36"	-	Unpainted	1936
Kalite, cast on 1/4" backing of moulding plaster, Grade D(Fine)	1 1/2"	4	.20	.39	.59	.61	.60	.67	.55	24"x 36"	-	Unpainted	1936
Kalite, cast on 1/4" backing of moulding plaster, Grade A(Coarse)	1 1/2"	4	.15	.34	.64	.74	.60	.69	.60	24"x 36"	-	Unpainted	1936
Kalite, cast on 1/4" backing of moulding plaster, Grade D(Fine)	2"	4	.22	.48	.55	.58	.54	.53	.55	24"x 36"	-	Unpainted	1936
Kalite, cast on 1/4" backing of moulding plaster, Grade A(Coarse)	2"	4	.23	.55	.73	.67	.64	.62	.65	24"x 36"	-	Unpainted	1936

CERTAIN-TEED PRODUCTS CORPORATION (Cont'd)

Material	Thickness	Mounting (See Footnote)	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
Kalite, cast on 1/4" backing of moulding plaster, Grade A(Coarse)	2"	4	.26	.51	.72	.69	.67	.71	.65	24"x 36"	- -	Spray painted 4 coats of Mural-tone paint.	1937

R. GUASTAVINO COMPANY

Akoustolith Tile Grade D	1"	4	.08	.13	.25	.54	.67	.42	.40	- -	-	Unpainted	1930
Akoustolith Tile Grade D	2"	4	.15	.26	.59	.74	.52	.50	.55	- -	-	Unpainted	1930
Akoustolith Tile Grade C	1 1/2"	4	.12	.19	.44	.61	.66	.56	.50	6"x 12"	7.5	Unpainted	1930
Akoustolith Tile Grade C	2"	4	.19	.26	.53	.64	.70	.56	.55	6"x 12"	10.1	Unpainted	1930
Akoustolith Tile Grade B-2	1"	4	.09	.17	.46	.77	.77	.58	.55	6"x 12"	4.6	Unpainted	1932
Akoustolith Tile Grade B-2	1 1/2"	4	.14	.30	.67	.87	.82	.57	.65	6"x 12"	6.1	Unpainted	1932
Akoustolith Tile Grade B-2	2"	4	.21	.50	.85	.81	.70	.70	.70	6"x 12"	8.5	Unpainted	1932
Akoustolith Tile Grade B-1	2"	5 (12"o.c.) Not nailed	.42	.75	.67	.75	.80	.78	.75	6"x 12"	9.4	Unpainted	1936
Akoustolith Tile Grade B-1	1 1/4"	5 (12"o.c.) Not nailed	.41	.83	.78	.72	.78	.82	.80	6"x 12"	5.8	Unpainted	1936
Akoustolith Tile Grade C	4"	10	.54	.70	.78	.85	.88	.81	.80	12"x 12"	19.5	Unpainted	1937
Akoustolith Tile Grade C	4"	4	.32	.82	.90	.77	.79	.81	.80	12"x 12"	19.5	Unpainted	1937
Akoustolith Tile Grade D	4"	10	.54	.80	.70	.88	.87	.74	.80	12"x 12"	18.8	Unpainted	1937
Akoustolith Tile Grade D	4"	4	.27	.76	.93	.78	.74	.69	.80	12"x 12"	18.8	Unpainted	1937

Material	Thickness	Mounting (See Footnote)	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
HAWAIIAN CANE PRODUCTS, LTD.													
Hawaiian Cane Tile	1"	1	.10	.40	.69	.78	.77	.79	.65	11 1/2"x 11 1/2"	0.75	Unpainted	1933
Hawaiian Cane Tile	1"	2	.24	.70	.40	.48	.54	.60	.55	12"x 12"	.81	Unpainted	1935
THE INSULITE COMPANY													
Insulite Acoustile Type 44	1 3/4"	4	.26	.42	.50	.57	.61	.59	.55	12"x 12"	1.47	Unpainted	1931
JOHNS-MANVILLE SALES CORPORATION													
Nashkote A	1/2"	1	.05	.13	.25	.26	.20	.18	.20	36"x 48"	- -	Painted 2 coats oil paint.	1929
Nashkote A	1/2"	1	.08	.15	.43	.62	.65	.58	.45	36"x 48"	- -	Same as above except membrane perforated with fine holes after painting.	1929
Nashkote A	3/4"	1	.09	.16	.27	.30	.23	.23	.25	36"x 48"	- -	Painted 2 coats oil paint.	1929
Nashkote A	3/4"	1	.11	.21	.51	.68	.71	.68	.55	36"x 48"	- -	Same as above except membrane perforated with fine holes after painting.	1929
Nashkote A	1"	1	.12	.20	.33	.33	.28	.28	.30	36"x 48"	- -	Painted 2 coats oil paint.	1929
Nashkote A	1"	1	.13	.26	.58	.73	.77	.71	.60	36"x 48"	- -	Same as above except membrane perforated with fine holes after painting.	1929
Nashkote B-332	1/2"	1	.09	.15	.31	.52	.74	.63	.45	36"x 48"	- -	Covered with perforated membrane.	1929
Nashkote B-332	3/4"	1	.12	.21	.40	.63	.81	.73	.50	36"x 48"	- -	Covered with perforated membrane.	1929
Nashkote B-332	1"	1	.19	.26	.51	.73	.89	.77	.60	36"x 48"	- -	Covered with perforated membrane.	1929
Sound Isolation Blanket (Rockwool)	-	4	.11	.58	.85	.83	.81	.83	.75	- -	1.5	Metal lath.	1932
Transite Acoustical Tile	1 1/8"	4	.19	.39	.77	.74	.70	.55	.65	12"x 12"	3.0	Transite, perforated 576 holes per sq ft, diameter 5/32".	1931

Material	Thickness	Mounting (See Footnote)	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
LUSE STEVENSON CO.													
Lusco Hair Felt	1"	4	.06	.27	.57	.77	.81	.83	.60	4'x 9'	-	No surface covering	1934
MAIZEWOOD PRODUCTS CORPORATION													
Maizewood Tile	1 1/2"	4	.23	.41	.63	.79	.70	.62	.65	12"x 12"	2.1	12 saw cuts across tile 1" deep.	1932
Maizewood Tile	1 1/2"	4	.21	.41	.64	.73	.70	.58	.60	12"x 12"	2.1	Same sample as above painted 1 coat glue size, 2 coats lead and oil at N.B.of S.	1932
NATIONAL GYPSUM COMPANY													
Acoustolic (Maftex)	1/2"	5	.44	.24	.31	.44	.48	.37	.35	- -	-	Unpainted	1930
Acoustolic	1/2"	5	-	.29	.28	.41	-	-	-	- -	-	Tinted with water soluble aniline color at N.B.of S.	1930
Acoustolic	1/2"	5	.40	.33	.31	.38	.37	.35	.35	- -	-	Painted with cold water paint at N.B.of S.	1930
Accustex	7/8"	4	-	.19	.41	.72	-	-	-	12"x 12"	2.06	- -	1932
Acoustex	1 1/8"	4	-	.25	.53	.79	-	-	-	12"x 12"	2.6	- -	1932
Acoustex	1 1/8"	5 (12"o.c.)	-	.74	.88	.93	-	-	-	12"x 12"	2.6	- -	1932
Acoustex Type 50R	15/16"	2 (1"x 3" furring)	.14	.32	.77	.91	.78	.79	.70	12"x 12"	2.16	Unpainted	1936
Acoustex Type 50R	15/16"	2 (1"x 2" furring)	.16	.34	.84	.95	.75	.98	.70	12"x 12"	2.16	Unpainted	1936
Acoustex Type 50R	15/16"	1	.11	.24	.54	.87	.80	.75	.60	12"x 12"	2.16	Unpainted	1936
Acoustex Type 60R	1"	1	.07	.24	.55	.87	.86	.88	.65	12"x 12"	-	Unpainted	1937
Acoustex Type 60R	1"	2 (1"x 3" furring)	.11	.33	.77	.92	.70	.96	.70	12"x 12"	2.07	Unpainted	1936

Material	Thickness	Mounting (See Footnote)	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	Size of Unit Tested	Wt. (lb) sq ft	Surface	Date
THE SPHINX ACOUSTICAL COMPANY													
Sphinxstone	2"	4	.10	.33	.78	.87	.71	.70	.65	18"x 24"	- -	Unpainted	1932
UNITED STATES GYPSUM COMPANY													
Acoustone Type D	3/4"	1	.10	.36	.73	.78	.75	.76	.65	12"x 12"	1.26	Unpainted	1937
Acoustone Type D	1"	1	.13	.48	.85	.83	.80	.85	.75	12"x 12"	1.73	Unpainted	1936
Quietile Type 80	1"	4	.06	.47	.76	.74	.72	.76	.65	12"x 12"	0.81	Unpainted, brush finish.	1932
Red Top Acoustic Tile	1/2"	1	.14	.22	.40	.48	.52	.51	.40	12"x 12"	0.55	Unpainted	1932
Thermofil	3"	4	.43	.39	.66	.78	.81	.93	.65	- -	- -	No surface covering.	1932
U. S. Gypsum Metal Tile, Rockwool pad.	1 1/2"	4	.12	.56	.91	.87	.78	.70	.80	12"x 12"	1.03 (pad)	Painted by mfr., perforated 2401 holes per sq ft	1933
WOOD CONVERSION COMPANY													
Balsam Wool	1"	4	.18	.36	.55	.65	.67	- -	.55	- -	.29	Scrim facing	1928
Krexstone Tile (Balsam Wool)	1"	6	.12	.24	.62	.73	.73	.78	.60	12"x 12"	0.83	Screen wire	1931
Nuwood Bevel Lap Tile	1/2"	6	.12	.19	.30	.40	.40	.51	.30	12"x 12"	0.69	Unpainted	1931
Nuwood Bevel Lap Tile	1"	6	.14	.19	.37	.37	.41	.56	.35	12"x 12"	1.41	Unpainted	1931

FOOTNOTES:

1. Cemented to gypsum wall board. This is considered equivalent to cementing to plaster or masonry.
2. Nailed on 13/16" x 2" furring 12" o.c. unless otherwise indicated.
3. Metal supports attached to 13/16" x 2" wood furring.
4. Laid directly on laboratory floor. As a rule the results obtained this way are the same as when the tile is cemented to gypsum wall board.
5. Nailed on 2 x 4's o.c. unless otherwise indicated.
6. Cemented to the floor of the reverberation chamber.
7. Back of sample covered with concrete.
8. Attached to metal suspension system. 4" air space back of tile.
9. Acoustic tile nailed to 13/16" x 2" furring 18" o.c. Space between furring filled with Rockwool.
10. Laid on 2 x 8's 12" o.c.

Table 2
Acoustical Plasters

Unless otherwise stated each sample of acoustical plaster was mixed according to the specifications furnished by the manufacturers and applied by a skilled plasterer on a false ceiling at the N.B.of S. The panels were laid on the floor of the Reverberation Chamber for test.

Material	Thickness	Coefficients 123	256	512	1024	2048	4096	Noise Coef.	No. of Coats	Base Coat	Application	Surface Treatment	Date
THE AMERICAN GYPSUM COMPANY													
Reverbolite Plaster	5/8"	.10	.32	.35	.40	.51	.35	.40	1st coat 1/4" 2nd coat 1/4" 3rd coat 1/8"	Gypsum plaster	2nd coat applied 24 hrs.after 1st coat. 3rd coat applied immediately after 2nd coat.	Floated with wood float.	1934
CALIFORNIA STUCCO PRODUCTS OF NEW ENGLAND, INC.													
Stuccostic Plaster Type A.D.	3/4"	.18	.36	.65	.65	.62	.62	.55	1st coat 7/16" 2nd coat 5/16"	Gypsum plaster	1st coat applied to half green base coat. 2nd coat applied 3 hrs. after 1st coat.	Troweled with steel trowel.	1935

CERTAIN-TEED PRODUCTS CORPORATION

Material	Thickness	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	No. of Coats	Base Coat	Application	Surface Treatment	Date
Kalite H Coarse Aggregate	1/2"	.36	.33	.46	.70	.66	.68	.55	1st coat 3/8" 2nd coat 1/8"	Gypsum plaster on metal lath, attached to 1" channels.	1st coat applied to dry base coat. 2nd coat applied 1 hr. after 1st coat.	Finished with steel trowel.	1935
Kalite H Coarse Aggregate	1/2"	.26	.31	.46	.67	.65	.68	.50	1st coat 3/8" 2nd coat 1/8"	Same sample as above.		Brush painted 2 coats non-bridging lacquer.	1936
Kalite H Coarse Aggregate	3/4"	.43	.38	.63	.78	.65	.70	.60	1st coat 5/8" 2nd coat 1/8"	Gypsum plaster on metal lath attached to 1" channels.	1st coat applied to dry base coat. 2nd coat applied 1 hr. after 1st coat.	Finished with steel trowel.	1935

CLEVELAND GYPSUM SUPPLY COMPANY

Material	Thickness	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	No. of Coats	Base Coat	Application	Surface Treatment	Date
Hushkote Acoustic Plaster	1/2"	.13	.24	.45	.71	.56	.49	.50	1st coat 1/4" 2nd coat 1/4"	3/4" Gypsum plaster on metal lath.	1st coat applied to dry base coat. 2nd coat applied 24 hrs. after 1st coat.	Finished with steel trowel.	1935
Hushkote Acoustic Plaster	5/8"	.16	.34	.50	.53	.43	.37	.45	1st coat 3/8" 2nd coat 1/4"	3/4" Gypsum plaster on metal lath.	1st coat applied to dry base coat. 2nd coat applied 24 hrs. after 1st coat.	Finished with steel trowel.	1937

Material	Thickness	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	No. of Coats	Base Coat	Application	Surface Treatment	Date
R. GUASTAVINO COMPANY													
Akoustolith Plaster	1/4"	.13	.21	.19	.23	.33	.45	.25	1 coat	Gypsum plaster	Applied on binder coat. See mfg. directions.	Floated	1931
Akoustolith Plaster	3/4"	.20	.26	.35	.56	.59	.50	.45	1 coat	Gypsum plaster	Applied on binder coat. See mfg. directions.	Floated	1932
HACHMEISTER - LIND COMPANY													
Hachmeister-Lind Acoustic Plaster	1/2"	.16	.19	.25	.36	.44	.49	.30	1st coat 1/4" 2nd coat 1/4"	Gypsum plaster	2nd coat applied immediately after 1st coat.	Stippled with large pins, holes 1/2" deep.	1930
NATIONAL GYPSUM COMPANY													
Macoustic Plaster (Trowel Finish)	1/2"	.15	.27	.42	.45	.36	.29	.40	1st coat 1/4" 2nd coat 1/4"	3/4" Gypsum plaster on metal lath.	1st coat applied to half green base coat. 2nd coat applied 2 hours after 1st coat.	Finished with steel trowel.	1936
Macoustic Plaster (Trowel Finish)	1/2"	.17	.27	.52	.76	.66	.55	.55	1st coat 3/4" 2nd coat 1/4"	3/4" Gypsum plaster on metal lath.	1st coat applied to dry base coat. 2nd coat applied 24 hrs. after 1st coat.	Finished with steel trowel.	1937
Macoustic Plaster (Trowel Finish)	3/4"	.25	.41	.67	.63	.52	.47	.55	1st coat 3/8" 2nd coat 3/8"	3/4" Gypsum plaster on metal lath.	1st coat applied to dry base coat. 2nd coat applied 24 hrs. after 1st coat.	Finished with steel trowel.	1937

Material	Thickness	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	No. of Coats	Base Coat	Application	Surface Treatment	Date
NATIONAL GYPSUM COMPANY (Cont'd)													
Rockwall Acoustic Plaster	1/2"	.13	.20	.35	.65	.70	.64	.50	1st coat 1/4" 2nd coat 1/4"	3/4" Gypsum plaster on metal lath.	1st coat applied to dry base coat. 2nd coat applied 3 hours after 1st coat.	Finished with steel trowel.	1935
NEWARK PLASTER COMPANY													
Acoustic Plaster	1/2"	.09	.23	.47	.77	.71	.75	.55	1st coat 1/4" 2nd coat 1/4"	3/4" Gypsum plaster on metal lath.	1st coat applied to dry base coat. 2nd coat applied 24 hours after 1st coat.	Finished with steel trowel.	1937
PACIFIC PORTLAND CEMENT CO.													
Calacoustic Plaster	1/2"	.15	.28	.44	.67	.66	.65	.50	1st coat 1/4" 2nd coat 1/4"	3/4" Gypsum plaster on metal lath.	1st coat applied to dry base coat. 2nd coat applied 72 hrs. after 1st coat.	Finished with cork float.	1936
UNITED STATES GYPSUM COMPANY													
Sabinite Plaster Hydraulic	1/2"	.14	.24	.27	.38	.49	.64	.35	1st coat 1/4" 2nd coat 1/4"	Gypsum plaster.	1st coat applied to dry base coat. 2nd coat applied after 1st coat had set and partly dried.	Floated with cork float.	1931
Sabinite Plaster A	1/2"	.16	.24	.38	.78	.75	.77	.55	1st coat 1/4" 2nd coat 1/4"	Gypsum plaster.	1st coat applied to dry base coat. 2nd coat applied 24 hrs. after 1st coat.	Floated with cork float.	1935

UNITED STATES GYPSUM COMPANY (Cont'd)

Material	Thickness	Coefficients 128	256	512	1024	2048	4096	Noise Coef.	No. of Coats	Base Coat	Application	Surface Treatment	Date
Sabinite Plaster A	3/4"	.13	.27	.59	.81	.74	.85	.60	1st coat 1/4" 2nd coat 1/4" 3rd coat 1/4"	3/4" Gypsum plaster on metal lath.	1st coat applied on dry base coat. 2nd coat applied 48 hrs. after 1st coat. 3rd coat applied 72 hrs. after 2nd coat.	Floated with cork float.	1935
Sabinite Plaster F	1/2"	.19	.22	.43	.80	.75	.75	.55	1st coat 1/4" 2nd coat 1/4"	3/4" Gypsum plaster on metal lath	1st coat applied on dry base coat. 2nd coat applied 48 hrs. after 1st coat.	Floated with cork float.	1936

Table 3

Audience seated in chairs of various types

A - cane seat chairs, open back
B - theatre chairs, box spring seat, heavily padded back
C - same as B, but single layer of padding on back
D - church pews, seating five

Absorption per person *

		128	256	512	1024	2048	Date
Women without coats,	A	0.7	1.3	2.3	3.6	4.6	1930
Women with coats,	A	1.3	2.4	4.0	5.8	6.7	1930
Men without overcoats,	A	1.3	2.1	4.1	5.5	7.4	1930
Men with overcoats,	A	2.3	3.2	4.8	6.2	7.6	1930
Mixed audience,	B			3.9	4.7		1929
Empty seat,	B		3.4	3.0	3.3	3.6	1929
Mixed audience,	C		3.5	4.1	4.9	4.2	1930
Empty seat,	C		3.0	2.5	2.9	3.1	1929
Mixed audience.	D		2.7	3.3	3.8	3.6	1930
Plywood Chair,			0.2	0.3	0.5	0.5	1930

* These figures are numerically equal to the number of square feet of a material having an absorption coefficient of 1.00, which would absorb the same amount of sound energy.

Suggestions Concerning the Proper Use of Acoustical Material

As there has been considerable misconception as to the proper use of acoustical material it is considered desirable to call attention to two of the fundamental principles underlying the formulas which are used in acoustical design. It is assumed in all of the formulas that (1) the absorption is proportional to the area of the absorbing material and that (2) there is a uniform distribution of sound energy. As a rule neither one of these assumptions is true.

It has been found from experiment when very small areas are used, such as the panels in a coffered ceiling having areas from 1 to 4 square feet and separated from each other by a foot or more, that the effective absorption of the material in these panels is greater than when the material is installed in one large area. In fact, for materials having large coefficients, this effective absorption may be as much as 50 percent more than one would expect from the coefficient.

It has also been found when all of the acoustical material is applied on one surface of a relatively small room, say 50,000 cubic feet or under, that this creates a non-uniform distribution of sound energy in the following manner. Let us assume that the ceiling of a room is covered with a highly absorbent material. Under these conditions the sound energy which is traveling between the floor and ceiling is absorbed quite rapidly, while that traveling between the untreated wall surfaces, having very little to absorb it, may continue for some considerable time. This persistence of sound energy between the untreated surfaces may cause the measured reverberation time to be considerably longer than would be computed using the ordinary reverberation formula and the coefficient usually given. For this reason, it is essential in small rooms that the acoustical material be distributed on the side walls as well as on the ceiling, if the effective absorption of the material is to be anywhere near that which one would expect from the coefficient of the material.

We also wish to call attention to the fact that a proper distribution of the acoustical material should be worked out in the initial plans of a building, as it is frequently impossible to obtain a satisfactory distribution after the interior design has been completed without taking into account the acoustical treatment.